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HEEL LINING FOR THE SHOE INDUSTRY

[Specification] **Field of the Invention**

[The]**The present** invention relates to a heel lining for [the] **a** shoe [industry], and to a method for the production of [the same.] **a heel lining.**

Background of the Invention

In the shoe industry, particularly wear-resistant materials are used for lining the back part of a shoe, the so-called heel cap. These materials are supposed to absorb the forces that are exerted on the shoe by the foot, particularly during the flexing movement, in the longitudinal direction, for one thing, and for another, they must be able to withstand the friction forces that are caused in the shoe while walking, since the foot moves at least partially up and down within it. In order to prevent the foot from unintentionally slipping out of the shoe, a material similar to rough leather or suede is traditionally used as a heel lining, which prevents the foot from slipping out of the shoe by the effect of the friction between the lining and the foot or the lining and the wearer's sock or stocking.

In addition to heel linings made from natural materials, synthetic materials are also used. These synthetic materials are **typically** needle-punched nonwoven fabrics that are produced using the dry method, by crimping, and made of polyester, viscose, polyamide, or polypropylene fibers, or of mixtures of these fibers. For this purpose, fiber layers with a surface weight of up to 800 g/m^2 are laid down and mechanically consolidated by intensive needle-punching. This process step alone is very time-consuming

Marked-Up Version of the
Substitute Specification

and therefore relatively cost-intensive. It is generally followed by shrinkage of the needle-punched nonwoven fabric by hot air or steam, resulting in compaction of the material as well as further consolidation with regard to adjustment of the density desired for the purpose of use. In order to achieve the necessary strength parameters such as tear resistance and tear propagation resistance of the needle-punched nonwoven fabric, the latter is impregnated with a latex binder dispersion that coagulates under the effect of heat, such as styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR) and subsequently dried. The latex proportion is about 30 to 60 wt.-% of the weight of the impregnated nonwoven fabric. The material prepared in this way is split into two to four thinner layers. This splitting process was taken over for nonwoven fabrics from the leather industry, in order to increase the productivity of nonwoven fabric production. The split products can be ground in order to make the surface uniform, or in order to improve the optical finish. Subsequently, a hot-melt glue is applied to one of the two sides, in order to simplify further processing. [A disadvantage] **Some of the disadvantages** of the synthetic heel linings used until now [has] **have** been, [in particular] **for example**, the very different strength values in the lengthwise and the crosswise direction, the loss in strength which occurs by splitting the fiber bundles that are arranged vertically as a result of needle-punching, and the lack of uniformity of the individual layers, caused by the position of the layers relative to the needle entry and exit side.

Description of the Present Invention

The present invention, in accordance with one embodiment, provides [The invention has set itself the task of indicating] a heel lining for the shoe industry that demonstrates tear resistance and tear propagation resistance values > 15 N in both the lengthwise and the crosswise direction, at surface weights of 180 to 350

g/m².

The [invention has furthermore set itself the task of indicating] **present invention also provides** a particularly suitable process for the production of such a heel lining.

This task is accomplished, according to **an exemplary embodiment of** the present invention, by a heel lining that is made up of a nonwoven fabric impregnated with a polymer, with a surface weight of 180 to 350 g/m², and tear propagation resistance values > 15 N in both the lengthwise and the crosswise direction, where the nonwoven fabric is made up of melt-spun, aerodynamically stretched multi-component endless filaments, with a titer < 2 dtex, immediately deposited to form a nonwoven layer, and the multi-component endless filaments, after preliminary consolidation, are split by at least 90% to produce supermicro endless filaments with a titer < 0.2 dtex, and consolidated. These heel linings demonstrate high tensile strength and friction wear resistance values at low surface weight.

Preferably, the heel lining is one in which the multi-component endless filament is a bicomponent endless filament of two incompatible polymers, particularly a polyester and a polyamide. As a result, the multi-component endless filament demonstrates good splittability and a very advantageous ratio of strength to surface weight.

Preferably, the heel lining is one in which the polyester portion of the multi-component endless filament is higher than the polyamide portion, particularly in the range of a weight ratio of the polyester portion to the polyamide portion of 1.1:3 to 3:1. As a result, the heel linings demonstrate a very textile feel and good resistance to aging.

A heel lining in which the multi-component endless filaments have a cross-section with an orange-like multi-segment structure is particularly preferred, where the segments alternately contain one of the two incompatible polymers.

Preferably, the heel lining is one in which the nonwoven fabric made of the multi-component endless filaments is pre-calandered for the purpose of preliminary consolidation. This causes the material to demonstrate very good uniformity in thickness.

Furthermore, a heel lining in which at least one of the incompatible polymers that forms the multi-component endless filament contains an additive, such as color pigments, permanently acting anti-statics and/or additives that influence the hydrophilic or hydrophobic properties, in amounts up to 15 wt.-%, is particularly preferred. In this way, the heel lining can be positively influenced with regard to its resistance to fading, its tendency to become electrostatically charged, the transport of perspiration, or the effect of accumulated moisture. Furthermore, the addition of color pigments into the spinning mass makes it possible to produce dark colors, resistant to friction wear.

Furthermore, a heel lining in which the multi-component endless filament is not crimped is particularly preferred, since this ensures the textile feel that results from the good splittability into supermicro endless filaments.

A heel lining in which the nonwoven fabric is impregnated with 20 to 50 wt.-% of a polymer, with reference to the starting weight of the nonwoven fabric, is particularly preferred according to the invention. At comparable degrees of impregnation, the heel lining demonstrates superior strength properties as compared with the known synthetic heel lining materials.

It is advantageous if the heel lining is one in which one of the two sides is provided with an application of hot-melt glue. Such a material is particularly well suited for further processing on automatic machines.

The process according to the present invention, for the production of the heel lining, includes the steps that multi-component endless filaments are spun from the melt, aerodynamically stretched, and immediately deposited to form a nonwoven layer, that preliminary consolidation takes place by needle-punching or calandering, and that the nonwoven fabric is consolidated by high-pressure fluid jets and, at the same time, split into supermicro endless filaments with a titer < 0.2 dtex, and subsequently impregnated with a polymer. The products obtained in this way are very uniform with regard to their strength, because the filament distribution in the product is isotropic, to a great extent. The products do not demonstrate any tendency towards delamination and demonstrate high modulus values as well as tear resistance and tear propagation resistance values.

Another advantageous further development of the process includes the step that consolidation and splitting of the multi-component endless filaments takes place in that the pre-consolidated nonwoven fabric is alternately impacted from both sides with high-pressure water jets, several times. This method of consolidation and splitting the multi-component endless filaments results in very dense nonwoven fabrics with smooth surfaces.

Preferably, consolidation and splitting of the multi-component endless filament is carried out on a unit with rotating screen drums. This form of the units permits the construction of very compact systems.

In particularly advantageous manner, impregnation of the nonwoven

fabric, which has been predominantly split into supermicro endless filaments and consolidated, is carried out with an aqueous polyurethane or NBR latex dispersion. In this way, residues of solvent are avoided, and impregnation with the polymer is carried out in particularly environmentally friendly manner.

In preferred manner, the impregnated material is still subjected to subsequent treatment by grinding or buffing. With these measures, the surface consistency and the feel of the material obtained can be further improved. Because of the microfilaments contained in the structure, this results in a particularly good and high-quality, nubuck-like surface, which is very similar to that of natural leather.

Example

A nonwoven fabric layer with a surface weight of approximately 160 g/m^2 is produced from a multi-component endless filament made up of 65 wt.-% poly(ethylene terephthalate) and 35 wt.-% poly(hexamethylene adipamide). The starting filaments have a titer of approximately 1.8 dtex and are made up of 16 segments, where polyester and polyamide segments alternate around a center axis, like orange wedges. The melt-spun multi-component endless filaments are aerodynamically stretched and deposited on a belt in random order. The nonwoven fabric layer obtained in this way is passed to a pre-calandering step at a temperature of approximately 95 °C and a pressure of approximately 100 bar. After mechanical pre-consolidation using needle-punching, water-jet treatment at a water pressure of approximately 100 bar takes place. Subsequently, splitting of the multi-component endless filaments into supermicro endless filaments with a titer of approximately 0.1 dtex and consolidation of the nonwoven fabric, using high-pressure water jets, take place. The treatment takes place twice from both sides, in each instance, at water pressures of 250 and 300 bar, and on screen bases with a mesh width of 60 to 100 mesh. The nonwoven

fabric is subsequently dried and subjected to impregnation with polymer, using a wet-in-dry treatment with NBR latex. Approximately 125 wt.-% NBR are applied, with reference to the starting weight of the nonwoven fabric, and are fixed by drying at 180 °C. After grinding, a heel lining with a weight of 260 g/m^2 and a thickness of 0.75 mm is obtained.

Comparison Example

A nonwoven fabric is produced from polyester and polypropylene staple fibers, using intensive needle-punching, and it is impregnated with NBR. Splitting results in a heel lining with a surface weight of 320 g/m^2 and a thickness of 0.85 mm.

A comparison of the strength values and the friction wear resistance is shown in the following Table 1. In this connection, the friction wear resistance was determined in such a way that a sample body with a diameter of 90 mm was clamped into a rotation chuck head and stressed with a scrubbing pressure of 2.8 N/cm^2. The angle of rotation of the chuck head is 50 degrees. The test sample is tested against a scrubbing element that has a diamond pattern on its surface. The measurement sample is wetted with water and put into cyclic back-and-forth motion, where a scrubbing cycle is composed of 300 back-and-forth movements, followed by a visual assessment using a grading sample.

		Example	**Comparison Example**
Weight	g/m^2	260	320
Thickness	mm	0.75	0.85
Surface	Grade	1.0	1.0
10% modulus lengthwise	N / 5 cm	220	310
10% modulus crosswise	N / 5 cm	160	85
Tear propagation resistance lengthwise	N	21	10
Tear propagation resistance crosswise	N	21	10
Friction wear (according to WN 3147/1)	Grade	1.0	1.0-1.5

Table 1